APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC- 1999-003

TITLE NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL - DUAL PAYLOAD ATTACH FITTING (DPAF) HOISTING, ASSEMBLY, AND PROCESSING AT VAFB NASA HAZARDOUS PROCESSING FACILITY (Bldg 1610)

DOCUMENT NUMBER/TITLE V134-Launch Preparation Document: DPAF SPACECRAFT Processing

PREPARED BY JAMES GUNNELS

DATE 8/24/99

REQUIRED APPROVAL

CONTRACTOR	✓ DESIGN	✓ R & QA	✓ OPERATIONS	✓ SAFETY
NASA	___ DESIGN	✓ R & QA	___ OPERATIONS	✓ SAFETY

30SW/SES

TYPE OR PRINT NAME	SIGNATURE	ORGN.	DATE
M. Stotts	[signature]	Boeing-Eng	8/24/99
H. Santos	[signature]	Boeing-Safety	24Aug99
J. Boyle	[signature]	Boeing-OPS	24Aug99
D. Malin	[signature]	Boeing-Qual.	8/24/99
D. NEWSOME	[signature]	NASA SAFETY	8/24/99
M. Glenn	[signature]	NASA SAFETY EI-C-A	8/25/99

CONTRACTOR DIRECTOR OF SAFETY

KSC FORM OT-4120 (11/94) (ONE TIME FORM-REPRINT NOT AUTHORIZED)

SLO-KSC-1999-003
AUGUST 1999
PAGE 1 OF 4

NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL

OPERATION: DUAL PAYLOAD ATTACH FITTING (DPAF) HOISTING, ASSEMBLY, AND PROCESSING AT VAFB NASA HAZARDOUS PROCESSING FACILITY (BLDG. 1610)

SUPPORTING DOCUMENTS:

1. SYSTEMS ASSURANCE ANALYSIS – SAA – 88CR000-028, 10-TON BRIDGE CRANE, BLDG. 1610.

2. LAUNCH PREPARATION DOCUMENT – LPD V134, DPAF SPACECRAFT PROCESSING

GENERAL DESCRIPTION:
This task processes two satellite payloads and installs them into a dual payload attach fitting (DPAF) system, a structure which carries the two satellites atop a single Delta II booster and deploys them sequentially on orbit.

Hoisting during processing includes the offload of four major DPAF components and placement on buildup stands, the installation of satellites onto payload attach fittings (PAF), and the final stacking and assembly of these components into the flight configuration.

Personnel are required to work beneath suspended loads in the following circumstances:

- To place hands beneath the load to clean spacecraft mating surfaces
- To install separation components and assist during the mating of satellites to their PAFs

This task is accomplished using NASA/USAF approved launch processing procedure V134. This analysis applies to all DPAF processing operations in Bldg. 1610.

RATIONALE/ANALYSIS:
The suspended load tasks comply with the NASA Alternate Safety Standard as follows:

Alternate Standard Requirement 1a:
Satisfactory cleaning of the mating surface (the bottom of the suspended load) must be accomplished by human hands in order to achieve design and mission clean requirements.

The design configuration of the mating interface requires the installation of hardware by hand during the mating process.

Alternate Standard Requirement 1b:
A secondary support system is not feasible for the cleaning operation because the separation interface represents the only primary structure support interface for the spacecraft .

During mating to the PAF, the PAF itself serves as a satisfactory secondary support system because it is fixed to the floor of the facility and the position of the technicians working under the load is below the PAF mating interface at all times.

Alternate Standard Requirement 1c:
The test procedure will limit the number of personnel beneath the suspended load to one for cleaning and two for mating to the PAF.

Alternate Standard Requirement 1d:
Boeing technicians will accomplish the cleaning and mating tasks as quickly and safely as possible to minimize exposure. Each operation is expected to expose personnel to a suspended load for less than two minutes for cleaning and less than five minutes for mating.

Alternate Standard Requirement 2:
Each operation will be reviewed by NASA on a case by case basis.

Alternate Standard Requirement 3:
NASA to approve suspended load operations and maintain a list of such approved operations. Lists to be made available to OSHA personnel upon request.

Alternate Standard Requirement 4:
Operational requirements will be included in LPD V134. The LPD requirements are derived from the Boeing System/Subsystem Test Requirements Document (S/SSTRD). These procedures will be on site for inspection during DPAF processing.

Alternate Standard Requirement 5:
NASA to be consulted and new approvals obtained if a new procedure not covered by the original analysis is deemed necessary due to unusual or unforeseen circumstances.

Alternate Standard Requirement 6:
The Bldg. 1610, 10-ton bridge crane is tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NASS/GO-1740.9.

The cranes are load tested at 100 percent rated capacity annually and have a monthly, quarterly, semi-annual, and annual preventive maintenance program to ensure proper operation. The cranes are load tested to 125 percent rated capacity when newly installed or when following a major repair or modification.

When lifting spacecraft, the cranes will be connected to a Boeing supplied hydraset. The maximum weight of a spacecraft will be approximately 2,500 pounds. The maximum weight of the hydraset and hoist linkages will not exceed 150 pounds.

The crane will be operated by personnel trained and certified on the overhead bridge crane in Bldg. 1610.

The crane will be operated with the hydraset only for hoisting and lowering during the mating operation.

Alternate Standard Requirement 7:
A System Assurance Analysis (SAA) has been completed for the Bldg. 1610 bridge crane. The SAA includes a Failure Mode and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis.

The SAA for the Bldg. 1610 10-ton crane identifies one Single Failure Point (SFP) for each use: the hoist gear reducer, which transmits power and reduces rotational speed from the hoist motor to the rope drum. The associated SAA CIL Sheets describe the SFP and identify all the rationales for accepting the risk of the SFP including design information, failure history, and the operational controls in effect to minimize the risks (maintenance, inspection, test, etc.).

There is no history of failure with the SFP in the critical failure mode. The use of high quality, reliable components and a comprehensive maintenance inspection and test program (including pre-operational checks) ensure that the crane operates properly. In addition, the crane was proof-load tested at 125 percent prior to acceptance.

Alternate Standard Requirement 8:
Pre-operational inspections of the lifting equipment and a functional test will be performed before lifting the load. These are called out in LPD V134 and are mandatory in all Boeing hoisting procedures.

Alternate Standard Requirement 9:
A trained and certified operator (certified per NSS/GO-1740.9) will remain at the crane controls while personnel are under the load.

Alternate Standard Requirement 10:
LPD V134 establishes appropriate safety control areas before initiating operations. Non-essential personnel are cleared from the operational area.

Alternate Standard Requirement 11:
Prior to all operations, the engineering task leader conducts a pre-task briefing to identify safety hazards, safety control areas, crew assignments, communications assignments, and general test conduct. The engineering task leader uses the operating procedure to conduct the task. Deviations to the procedure require approval from various groups including

Safety if the deviation affects the safety of the operation or changes the hazard level of the task.

Alternate Standard Requirement 12:
Personnel beneath the suspended load will be in voice contact with the crane operator and engineering test conductor throughout the operation. At any time during the operation, anyone can call a stop to crane movement if they see a potential hazard. The crane operator will have full visual contact with the load throughout the operation.

Alternate Standard Requirement 13:
The engineering test conductor, the crane operator, and other personnel assigned to the task will be in visual contact with the personnel beneath the suspended load throughout the operation.

Alternate Standard Requirement 14:
NASA shall conduct periodic reviews to ensure the continued safety of the procedures.

Alternate Standard Requirement 15:
NASA action to provide copies of the associated hazards analyses to the OSHA Office of Federal Agency Programs.

APPROVAL: DATE:

Daryl L. Frank 8/25/99

Daryl L. Frank
Associate Director,
Space Shuttle Assurance
Kennedy Space Center